

CLAIMS

1. An apparatus, comprising:
 - one of a pool and a spa to contain a liquid;
 - 5 at least one light source, supported by the one of the pool and the spa, to illuminate the liquid;
 - at least one sensor to output at least one detection signal in response to a detectable condition; and
 - at least one controller, coupled to the at least one light source and the at least one
 - 10 sensor, to control radiation output by the at least one light source based on the at least one detection signal.
2. The apparatus of claim 1, wherein the one of the pool and the spa has a range of typical liquid levels of the liquid during use, and wherein the at least one light source
- 15 is adapted to be disposed below the range of typical liquid levels.
3. The apparatus of claim 2, wherein the at least one light source includes means for engaging the at least one light source mechanically and electrically with a conventional light socket supported by the one of the pool and the spa.
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4. The apparatus of claim 2, further including an encapsulant, in contact with at least the at least one light source, to protect the at least one light source from moisture.
5. The apparatus of claim 1, wherein the at least one light source includes at least one
- 25 LED.
6. The apparatus of claim 5, wherein the at least one LED includes at least two differently colored LEDs.
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7. The apparatus of claim 5, wherein the at least one LED includes at least one red LED, at least one green LED, and at least one blue LED.

8. The apparatus of claim 1, wherein the at least one controller is adapted to determine a readiness for use of the liquid based on the at least one detection signal, and is further adapted to control the radiation output by the at least one light source so as to indicate to a user the readiness for use of the liquid.

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9. The apparatus of claim 1, wherein the at least one detectable condition includes at least one environmental condition in or external to the liquid, and wherein the at least one sensor is adapted to output the at least one detection signal in response to the at least one environmental condition.

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10. The apparatus of claim 9, wherein the at least one sensor is adapted to vary the at least one detection signal based on changes in the at least one environmental condition.

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11. The apparatus of claim 9, wherein:

the at least one environmental condition includes an illumination condition in or external to the liquid; and

the at least one sensor includes at least one light sensor.

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12. The apparatus of claim 9, wherein:

the at least one environmental condition includes a temperature in or external to the liquid; and

the at least one sensor includes at least one temperature sensor.

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13. The apparatus of claim 9, wherein:

the at least one environmental condition includes a force in or external to the liquid; and

the at least one sensor includes at least one force transducer.

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14. The apparatus of claim 9, wherein:

the at least one environmental condition includes at least one sound wave in or external to the liquid; and

the at least one sensor includes at least one pressure transducer.

15. The apparatus of claim 9, wherein:

the at least one environmental condition includes at least one weather condition
5 external to the liquid; and
the at least one sensor is adapted to output the at least one detection signal in
response to the at least one weather condition.

16. The apparatus of claim 15, wherein:

10 the at least one weather condition includes an atmospheric pressure; and
the at least one sensor includes at least one barometer.

17. The apparatus of claim 15, wherein:

the at least one weather condition includes an ambient humidity; and
15 the at least one sensor includes at least one humidity sensor.

18. The apparatus of claim 9, wherein:

the at least one environmental condition includes a presence of electromagnetic
radiation within a particular band of wavelengths in or external to the liquid; and
20 the at least one sensor is adapted to output the at least one detection signal in
response to the presence of the electromagnetic radiation within the particular band of
wavelengths.

19. The apparatus of claim 9, wherein:

25 the at least one environmental condition includes a motion in or external to the
liquid; and
the at least one sensor includes at least one motion sensor.

20. The apparatus of claim 9, wherein:

30 the at least one environmental condition includes a presence of at least one
thermal body in or external to the liquid; and
the at least one sensor includes at least one thermal detector.

21. The apparatus of claim 1, wherein the at least one detectable condition includes at least one liquid condition of the liquid, and wherein the at least one sensor is adapted to output the at least one detection signal in response to the at least one liquid condition.
22. The apparatus of claim 21, wherein the at least one sensor is adapted to vary the at least one detection signal based on changes in the at least one liquid condition.
23. The apparatus of claim 21, wherein the at least one liquid condition includes a temperature of the liquid.
24. The apparatus of claim 21, wherein the at least one liquid condition includes a concentration of at least one substance in the liquid.
25. The apparatus of claim 24, wherein the at least one liquid condition includes a salt concentration in the liquid.
26. The apparatus of claim 24, wherein the at least one liquid condition includes a chlorine concentration in the liquid.
27. The apparatus of claim 21, wherein the at least one liquid condition includes a bacteria level in the liquid.
28. The apparatus of claim 1, wherein the at least one detectable condition includes at least one operating condition of the at least one light source, and wherein the at least one sensor is adapted to output the at least one detection signal in response to the at least one operating condition.
29. The apparatus of claim 28, wherein the at least one sensor is adapted to vary the at least one detection signal based on changes in the at least one operating condition.

30. The apparatus of claim 28, wherein the at least one operating condition includes a temperature of the at least one light source.

5 31. The apparatus of claim 28, wherein the at least one operating condition includes an electrical current of the at least one light source.

32. The apparatus of claim 28, wherein the at least one controller controls the radiation output by the at least one light source based on the at least one detection signal so as to maintain safe operation of the at least one light source.

10 33. The apparatus of claim 32, wherein the at least one controller controls the radiation output by the at least one light source based on the at least one detection signal so as to maintain the at least one operating condition of the at least one light source within a predetermined range.

15 34. The apparatus of claim 32, wherein the at least one controller controls the radiation output by the at least one light source based on the at least one detection signal so as to provide at least one indication to a user via the radiation output if the at least one operating condition of the at least one light source does not fall within a
20 predetermined range.

35. An apparatus, comprising:

at least one light source to illuminate a liquid, the at least one light source including at least two differently colored LEDs to generate variable color radiation;

25 at least one sensor to output at least one detection signal in response to a detectable condition; and

at least one controller, coupled to the at least one light source and the at least one sensor, to control the variable color radiation generated by the at least one light source based on the at least one detection signal.

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36. A method for illuminating a liquid, comprising acts of:

illuminating the liquid with radiation output simultaneously by at least two differently colored LEDs; and
controlling the radiation based on at least one detectable condition.

5 37. A method for illuminating a liquid in one of a pool and a spa, comprising acts of:
a) illuminating the liquid in the one of the pool and the spa with variable color radiation; and

b) controlling the variable color radiation based on at least one detectable condition.

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38. The method of claim 37, wherein the act b) comprises an act of:

controlling at least one of an intensity and a color of the variable color radiation based on the at least one detectable condition.

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39. The method of claim 37, wherein the act b) comprises acts of:

determining a readiness for use of the liquid based on the at least one detectable condition; and

controlling the variable color radiation so as to indicate to a user the readiness for use of the liquid.

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40. The method of claim 37, wherein the at least one detectable condition includes at least one environmental condition in or external to the liquid, and wherein the act b) comprises an act of:

controlling the variable color radiation based on the at least one environmental condition.

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41. The method of claim 40, wherein the act b) comprises an act of:

varying the variable color radiation based on changes in the at least one environmental condition.

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42. The method of claim 40, wherein the at least one environmental condition includes an illumination condition in or external to the liquid, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the at least one illumination
5 condition.
43. The method of claim 40, wherein the at least one environmental condition includes a temperature in or external to the liquid, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the temperature.
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44. The method of claim 40, wherein the at least one environmental condition includes a force in or external to the liquid, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the force.
- 15 45. The method of claim 40, wherein the at least one environmental condition includes at least one sound wave in or external to the liquid, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the at least one sound wave.
- 20 46. The method of claim 40, wherein the at least one environmental condition includes at least one weather condition, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the at least one weather condition.
- 25 47. The method of claim 46, wherein the at least one weather condition includes an atmospheric pressure, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the atmospheric pressure.
- 30 48. The method of claim 46, wherein the at least one weather condition includes an ambient humidity, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the ambient humidity.

49. The method of claim 40, wherein the at least one environmental condition includes a presence of electromagnetic radiation within a particular band of wavelengths in or external to the liquid, and wherein the act b) comprises an act of:

controlling the variable color radiation based on the presence of the
5 electromagnetic radiation within the particular band of wavelengths.

50. The method of claim 40, wherein the at least one environmental condition includes a motion in or external to the liquid, and wherein the act b) comprises an act of:

controlling the variable color radiation based on the motion.
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51. The method of claim 40, wherein the at least one environmental condition includes a presence of at least one thermal body in or external to the liquid, and wherein the act b) comprises an act of:

controlling the variable color radiation based on the presence of the at least one
15 thermal body.

52. The method of claim 37, wherein the at least one detectable condition includes at least one liquid condition of the liquid, and wherein the act b) comprises an act of:

controlling the variable color radiation based on the at least one liquid condition.
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53. The method of claim 52, wherein the act b) comprises an act of:

varying the variable color radiation based on changes in the at least one liquid
condition.

25 54. The method of claim 52, wherein the at least one liquid condition includes a temperature of the liquid, and wherein the act b) comprises an act of:

controlling the variable color radiation based on the temperature of the liquid.

55. The method of claim 52, wherein the at least one liquid condition includes a
30 concentration of at least one substance in the liquid, and wherein the act b) comprises an act of:

controlling the variable color radiation based on the concentration of the at least one substance in the liquid.

56. The method of claim 55, wherein the at least one liquid condition includes a salt
5 concentration in the liquid, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the salt concentration in the liquid.

57. The method of claim 55, wherein the at least one liquid condition includes a chlorine
10 concentration in the liquid, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the chlorine concentration in the liquid.

58. The method of claim 52, wherein the at least one liquid condition includes a bacteria
15 level in the liquid, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the bacteria level in the liquid.

59. The method of claim 37, wherein the at least one detectable condition includes at
least one operating condition of at least one light source that generates the variable
20 color radiation, and wherein the act b) comprises an act of:
controlling the variable color radiation based on the at least one operating
condition of the at least one light source.

60. The method of claim 59, wherein the act b) comprises an act of:
25 varying the variable color radiation based on changes in the at least one operating
condition.

61. The method of claim 59, wherein the at least one operating condition includes an
operating temperature of the at least one light source, and wherein the act b)
30 comprises an act of:
controlling the variable color radiation based on the operating temperature of the
at least one light source.

62. The method of claim 59, wherein the at least one operating condition includes an electrical current of the at least one light source, and wherein the act b) comprises an act of:

5 controlling the variable color radiation based on the electrical current of the at least one light source.

63. The method of claim 59, wherein the act b) comprises an act of:

 b1) controlling the variable color radiation based on the at least one operating
10 condition so as to maintain safe operation of the at least one light source.

64. The method of claim 63, wherein the act b1) includes an act of:

 controlling the variable color radiation so as to maintain the at least one operating
condition of the at least one light source within a predetermined range.
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65. The method of claim 63, wherein the act b1) includes an act of:

 controlling the variable color radiation so as to provide at least one indication to a
user if the at least one operating condition of the at least one light source does not fall
within a predetermined range.
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